CLAIMS

1. An image wavelength conversion device,

wherein one end and the other end of each of a multitude of quasi-phase-matching sum frequency generating optical waveguides are aligned in a two-dimensional plane to form an optical waveguide array,

wherein one plane of the optical waveguide array forms an incident plane which includes respective waveguides as elements thereof, and the other plane of the optical waveguide array forms an exit plane which includes waveguides corresponding to the waveguides of the incident plane as elements thereof, and

wherein, from an incident light (λ_1) and an excitation light (λ_2) incident to an arbitrary element of the incident plane, an output light (λ_3) is generated in the corresponding waveguide element, the output light (λ_3) having the relationship of $(\lambda_1)^{-1}+(\lambda_2)^{-1}=(\lambda_3)^{-1}$ in which λ_1, λ_2, and λ_3 represent the wavelength of the incident light, the wavelength of the excitation light, and the wavelength of the output light, respectively.

2. The image wavelength conversion device according to Claim 1,

wherein the incident light is an invisible light ranging from the infrared light to the millimeter wave and the excitation light has a wavelength for making the output light a visible light, and wherein the incident light is most preferably an infrared light of 3.5 μm and the excitation light and the output light are 0.8 μm and 0.65 μm, respectively.

3. The image wavelength conversion device according to Claim 1,

wherein the optical waveguide array having a constant opening

corresponding to the incident light is arranged in an m×n matrix state, and the mixing for generating the sum frequency is performed in each of the waveguides.

4. A method of manufacturing an image wavelength conversion device, comprising steps of:

preparing a nonlinear optical crystal wafer;

forming a polarization-inverted portion on the nonlinear optical crystal wafer with a constant period in a constant direction;

preparing optical waveguide elements by separating the nonlinear optical crystal wafer into a multitude of optical waveguides having a constant length in a constant direction;

joining the optical waveguide elements, with the optical waveguide elements being optically separated from one another; and

forming a collective plane including one end plane of each of the elements into an incident plane, and forming a collective plane including the other end plane of each of the elements into an exit plane.

5. An image wavelength conversion device system comprising:

an image wavelength conversion device including an incident plane and an exit plane formed by two-dimensionally aligning one end and the other end of each of a multitude of quasi-phase-matching sum frequency generating optical waveguides;

an image forming optical system for forming an image (wavelength λ_1) on the incident plane of the image wavelength conversion device;

an excitation light optical system for applying an excitation light

(wavelength λ_2) to the incident plane of the image wavelength conversion device; and

image receiving means for receiving an image of a third wavelength (wavelength λ_3) appeared on the exit plane of the image wavelength conversion device.